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New taxa of the lichen genus *Pertusaria* from China

Qiang Ren* & Na Zhao

College of Life Science, Shandong Normal University, Jinan, 250014, China

*Correspondence to: *rendaqiang@hotmail.com*

Abstract — Three new species of *Pertusaria* from southwestern China are described, differentiated by morphology, anatomy, and chemistry. *Pertusaria wangii* is characterized by broad lecanorate verrucae, 8-spored asci, and production of norstictic acid. *Pertusaria hengduanensis* is characterized by 1-spored asci, 3-5 apothecia per verruca, and production of protocetraric acid. *Pertusaria lijiangensis* is characterized by 1-spored asci and the presence of hypothamnolic and cryptothamnolic acids.

Key words — *Ascomycota*, *Pertusariaceae*, taxonomy

Introduction

Pertusaria DC. is a highly diverse and globally distributed genus of microlichens. The apothecial structure, number of ascospores per ascus, spore structure, and chemistry are diagnostic in identifying species within the genus (Oshio 1968, Dibben 1980, Archer 1997, Schmitt & Lumbsch 2004). Although new records and new species have been reported in recent years (Zhao et al 2004, Ren et al 2009, Ren 2013), species diversity in *Pertusaria* from China is not yet determined with certainty. During a systematic survey of *Pertusaria* species in southwestern China, some interesting specimens were found that are proposed here as three new species.

Materials & methods

This report is based on specimens housed in SDNU (the Lichen Section of Botanical Herbarium, Shandong Normal University), KUN (Herbarium, Kunming Institute of Botany, CAS), and HMAS-L (the Lichen Section of Herbarium, Institute of Microbiology, CAS). A stereo-microscope (Olympus SZ 51) and a compound microscope (Olympus CX 21) were routinely used for the morphological and anatomical studies on all materials. Color reactions (spot tests) were made using standard methods (Orange et al. 2001). The chemical constituents were identified using thin layer chromatography (TLC) (Culberson 1972) and gradient-elution high performance liquid chromatography (HPLC) (Lumbsch 2002).

New species

Pertusaria wangii Q. Ren, **sp. nov.** PLATE 1A

MYCOBANK MB 807130

Differs from *Pertusaria submultipuncta* by its having 8 ascospores per ascus.

TYPE: China. Yunnan province, Lushui County, on the roadside between Fugong and Lushui Counties, 68 km north of Lushui county, alt. 2950 m, on dead twigs, 7 Jun. 1981, X.Y. Wang, X. Xiao & J.J. Su 2718 (**holotype**, HMAS-L).

ETYMOLOGY: the epithet "*wangii*" honours Professor Wang Li-Song (KUN), who has collected specimens and described the lichen diversity in southwestern China.

THALLUS gray, moderately thick, epiphloedal, without a definite margin; UPPER SURFACE initially tuberculate, later heavily rugose-plicate, generally matt, fissured. SOREDIA AND ISIDIA absent. FERTILE VERRUCAE lecanorate, concolorous with thallus, numerous, well dispersed or occasionally crowded and rarely fused, 1–1.5 mm in diam.. DISCS red, level or usually deeply sunken (in older verrucae), white-pruinose, the verrucal margins thick, initially entire and later ruptured forming a false secondary edge to the verrucae. APOTHECIA 1 per verruca, the fruit centre hyaline. EPITHECIUM red-brown, K–. ASCOSPORES 8 per ascus, ellipsoid, often uniseriate, occasionally irregular, 13–20 × 5–8 µm.

SPOT TESTS — K+ yellow to red, C–, KC–, P+ orange, UV–. Secondary metabolite: norstictic acid (TLC).

SUBSTRATE AND ECOLOGY — on dead twigs; at present known only from the type specimen.

COMMENTS — *Pertusaria wangii* is characterized by broad lecanorate verrucae, 8-spored asci, and the production of norstictic acid. Morphologically, the new species is similar to *P. submultipuncta* Nyl., which differs by having 1 ascospore per ascus (Oshio 1968) and to *P. ambigens* (Nyl.) Tuck., which differs by its South African distribution and production of connorstictic, protocetraric, and picrolichenic acids in addition to norstictic acid (Dibben 1980).

Pertusaria hengduanensis Q. Ren, **sp. nov.** PLATE 1B

MYCOBANK MB 807131

Differs from *Pertusaria lacericans* by its smaller ascospores and 3–5 apothecia per verruca.

TYPE: China. Yunnan province, Gongshan County, Qiqi Nature Reserve, alt. 1900 m, on tree trunk, 19 Jul. 1982, M. Zang Herb. No. 1452 (**holotype**, KUN).

ETYMOLOGY: referring to the Hengduan Mountains in southwestern China + the Latin suffix *ensis*, indicating place of origin.

THALLUS gray, moderately thick, epiphloedal, the margin ± entire; UPPER SURFACE smooth to tuberculate, or rugose-plicate (in older parts), generally matt, fissured. SOREDIA AND ISIDIA absent. FERTILE VERRUCAE concolorous

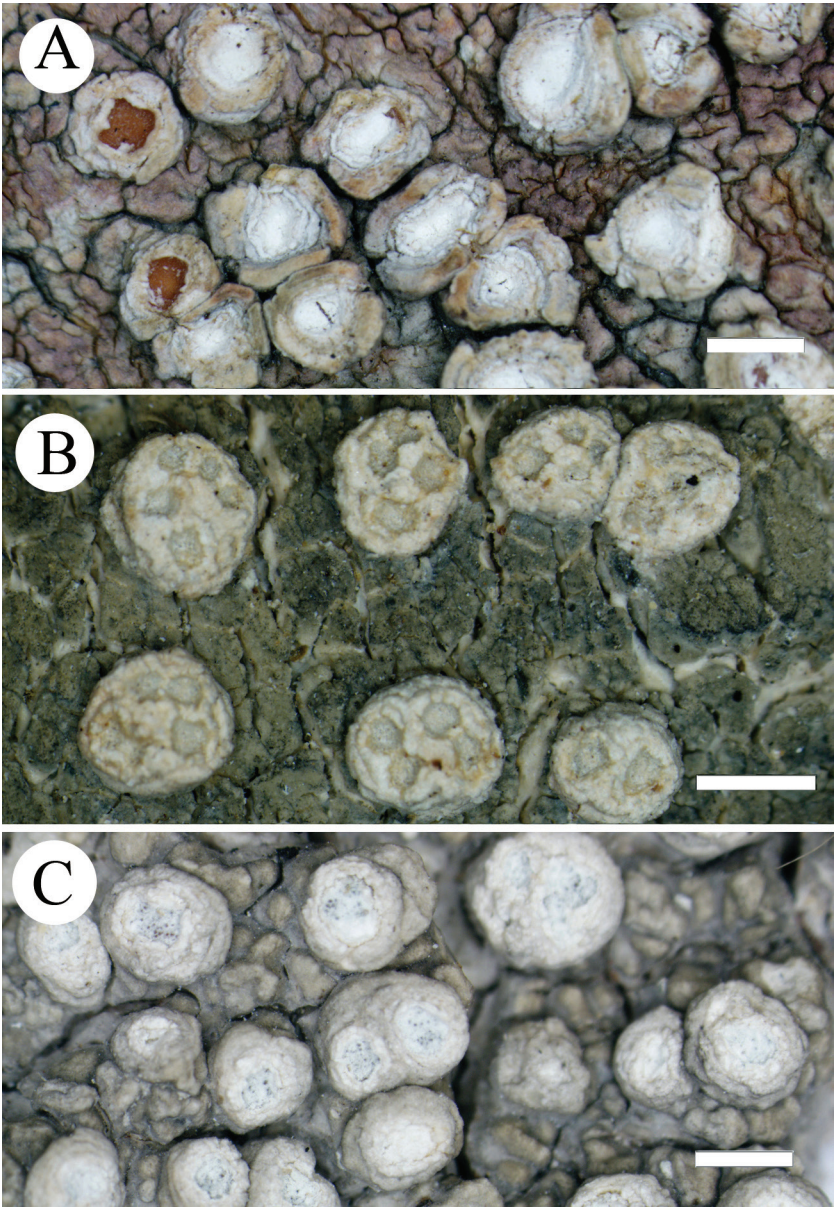

Plate 1. A, *Pertusaria wangii* (holotype, HMAS-L); B, *Pertusaria hengduanensis* (holotype, KUN); C, *Pertusaria lijiangensis* (holotype, SDNU). Scale bars = 1 mm.

with thallus, numerous, well dispersed or occasionally crowded, (0.8–)1–1.5 (–2) mm in diam.. Discs brown to black, 0.2–0.5 mm in diam., level, white-pruinose. Apothecia mostly 3–5 per verruca, lecanorate, the fruit centre hyaline. Epithecium red-brown, K–. Ascospores 1 per ascus, cylindric, 120–140 × 35–58 µm. Spore wall single, c. 3 µm thick.

Spot tests — K+ yellow, C–, KC+ pink, P+ orange-red, UV–. Secondary metabolite: protocetraric acid (TLC).

Substrate and ecology — on bark or dead twigs, and at present only known from Hengduan Mountains in southwestern China.

Additional specimen examined — **CHINA. Yunnan**: Lushui County, Pianma Town, on dead twigs, in broad-leaved evergreen forest, 29 May 1981, X.Y. Wang et al. 1835 (HMAS-L).

Comments — *Pertusaria hengduanensis* is characterized by 1-spored asci, 3–5 apothecia per verruca, and production of protocetraric acid. It is chemically similar to the Australian species *P. lacericans* A.W. Archer, which differs by its one apothecium per verruca and longer spores (170–180 µm; Archer 1991).

Pertusaria lijiangensis Q. Ren, **sp. nov.** Plate 1C

MycoBank MB 807133

Differs from *Pertusaria hypothamnolica* by its producing cryptothamnolic acid and lacking soredia.

Type: China. Yunnan province, Yulong County, Lijiang Alpine Botanical Garden, alt. 3590 m, on bark of *Rhododendron* sp., 16 Aug. 2011, Q. Ren 2011174 (**holotype**, SDNU).

Etymology: referring to Lijiang in Yunnan Province + the Latin suffix *ensis*, indicating place of origin.

Thallus grayish to gray, thin to thick, to 2 mm thick when on rock, epiphloedal, the margin ± entire and seldom zoned (but generally lighter colored than thallus); upper surface smooth to tuberculate, generally matt or only the margin shiny, continuous to slightly fissured, but rarely areolate. Soredia and isidia absent. Fertile verrucae concolorous with thallus, lecanorate, numerous, well dispersed to crowded, occasionally fused, (0.5–)1–1.5(–2) mm in diam.. Discs pink to black, 0.5–1.0 mm in diam., level, slightly white-pruinose. Apothecia mostly 1 per verruca, at times 2–3 per verruca, the fruit centre hyaline. Epithecium red-brown, K–. Ascospores 1 per ascus, cylindric, 130–230 × 45–85 µm. Spore wall single, 3–9 µm thick.

Spot tests — K+ yellow becoming deeply purple, C+ pink, KC+ red, P+ yellow, UV–. Secondary metabolites: hypothamnolic acid (major), cryptothamnolic acid (major), decarboxyhypothamnolic acid (trace) (HPLC).

Substrate and ecology — on various kinds of barks or dead branches, especially on *Rhododendron* spp., *Quercus* spp., and *Pinus* spp. etc; rarely on rock.

Additional specimens examined — **CHINA**. **Yunnan Province**: Lijiang City, Lijiang Alpine Botanical Garden, alt. 3210 m, on *Rhododendron* sp., 16 Aug. 2011, Q. Ren 2011380 (SDNU); on *Quercus pannosa*, 16 Aug. 2011, Q. Ren 2011374 (SDNU); alt. 3380 m, on *Quercus pannosa*, 16 Aug. 2011, Q. Ren 2011218 (SDNU); alt. 3590 m, on bark, 16 Aug. 2011, Q. Ren 2011169 (SDNU); on *Rhododendron* sp., 16 Aug. 2011, Q. Ren 2011200, 2011454 (SDNU); Yulong Snow Mountain, alt. 3300 m, on bark, 14 Aug. 1982, J.N. Wu & A.T. Liu 82-195 (HMAS-L); alt. 3100 m, on trunk of rotten wood, 3 Aug. 1981, X.Y. Wang et al. 5015 (HMAS-L); Da li City, Mountain Cangshan, alt. 3450 m, on bark of *Pinus armandii*, 14 Aug. 2011, Q. Ren 2011444 (SDNU); Jianchuan County, Shibaoshan, alt. 2640 m, on bark of *Quercus acutissima*, 17 Aug. 2011, Q. Ren 2011287 (SDNU). **Guizhou Province**: Kaili City, Leishan County, Mountain Leigong, 26°23.029′N 108°12.445′E, alt. 892 m, on bark, 2 Apr. 2011, Z.T. Zhao 20102785 (SDNU); alt. 1800 m, on bark, 2 Apr. 2011, Y. L. Cheng 20112031, 20112155 (SDNU). **Xizang**: Linzhi County, Lulang Town, alt. 3500 m, on bark, 12 Jul. 2011, Y.L. Cheng 20118137 (SDNU). **Zhejiang Province**: Hangzhou City, Mount Tianmu, alt. 1500 m, on rock, 19 Oct. 2010, L. Lü 20104517 (SDNU).

Comments — Incorrectly known to Chinese lichenologists previously as *P. leptospora* Nitschke (= *P. multipuncta* (Turner) Nyl.), *P. lijiangensis* is characterised by asci with 1 ascospore and hypothamnolic and cryptothamnolic acids as major substances. The species is chemically similar to the North American species, *P. hypothamnolica* Dibben, which differs by producing soredia (restricted to the verrucae) and by containing lichexanthone (Dibben 1980).

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